Dilemma of Choice: Efficient Sensor Placement in Mobile Sensor Networks

Computer Engineering and Networks Laboratory (TIK)
ETH Zurich

**Program:** Internship Program for Female Undergraduate Students or Undergrad Research Opportunity Program

**Study Level Required:** 4th or 5th year

**Desired Duration:** 10 weeks

**Project Description:**

Wireless sensor networks (WSN) are distributed collections of sensing devices, called sensor nodes, installed at various locations in order to cooperatively perceive the environment. Each device is equipped with a microprocessor, a wireless radio transceiver for data communication and several sensors. Sensor nodes are often battery-powered which sets limitations on the amount of sensing, processing and communication operations the nodes can perform during their lifetime.

Depending on how well the area of interest is covered with sensing devices, cooperative sensing can be more or less efficient. Some applications request uniform sensor distribution in the area to make best use of sensor data, others might require higher sensor density in areas with higher variation of sensor values. We consider area coverage in space and in time, since a sensor measurement is valid only for a limited time and in a small vicinity of the point where the measurement was performed.

In large-scale deployments, WSNs need to cover very large areas. For example, covering the city of Zurich would need the installation of hundreds of thousands of sensors, which is too expensive and difficult to achieve. Our application makes use of mobile sensor nodes to decrease the number of required sensing devices. The sensor nodes are mounted on top of public transport vehicles (trams and buses) in the city of Zurich. This installation allows to do sensor measurements along the corresponding tracks.

One of the problems we face in this setting is to decide on the set of trams and buses to pick in order to achieve the best possible coverage given a fixed number of sensor nodes. Evaluating combinations of all possible sets of vehicles is very complex and leads to a dilemma of choice (e.g., there are 14 tram lines in the city of Zurich with over 15 trams operating on each line). The goal of this project is to design a heuristic algorithm and implement it as part of an application which would take a public transport network of a city and output a collection of those vehicles that should be used for sensor node installation on top of them. The resulting collection should cover the city according to a given coverage requirement. We already have some ideas how a solution might look like, however, we are also open for suggestions from your side.

**Required Skills:** Curiosity and interest in puzzle solving, good programming skills (Java, C or python)

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**Web Link to our Lab:** Computer Engineering Group (TEC), http://www.tik.ee.ethz.ch/~tec/